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10/771,285	02/05/2004	Atsushi Teraji	NS-US035183	3237

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EXAMINER	
PATEL, SHAMBHAVI K	
ART UNIT	PAPER NUMBER
2128	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/771,285	TERAJI ET AL.	
	Examiner	Art Unit	
	SHAMBHAVI PATEL	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 November 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-20 have been presented for examination.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d).

Response to Arguments

3. In view of Applicant's amendments and arguments, the 35 U.S.C. 112 rejection is withdrawn.

4. Applicant's arguments regarding the 35 U.S.C. 101 rejection and the prior art rejection have been fully considered but they are not persuasive.

Regarding the 35 U.S.C. 101 rejection:

i. **Applicant submits** that the claimed method of modeling flame propagation is tied to a particular machine (i.e. a combustion chamber).

Examiner notes that there is no support in the specification for using an actual combustion chamber for carrying out the claimed steps. The claim appears to recite only modeling steps and do not require a particular machine for execution.

Regarding the prior art rejection:

ii. **Applicant submits**, regarding claim 1, that the Poinsot publication is silent about determining flame growth resulting from turbulent combustion as a function of a turbulent Reynold's number.

Examiner notes the right-hand column on page 533, which states: "The first level consists in using **Reynolds**- or Favre averaged balance equations together with closure rules to deal with the flow dynamics **in combination with a turbulent combustion model** to treat the conversion of chemical species and the heat release in the flowfield."

iii. **Applicant submits**, regarding claim 11, that the Poinsot publication is silent about determining the flame growth resulting from laminar combustion as being proportional to both a laminar flame speed and a ratio of a temperature of a burned portion to a temperature of an unburned portion and as a function of the Karlowitz number.

Examiner notes that Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 1-20 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. **Claims 1 and 11** are directed to modeling flame propagation, and are not explicitly nor inherently tied to a particular machine for execution.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-6, 9, 11-15 and 19 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by **Poinsot ("Applications of Direct Numerical Simulation to Premixed Turbulent Combustion")**.

Regarding claim 1:

Poinsot discloses a method of modeling flame propagation comprising:

a. defining a flame surface area density of a flame as a flame surface area per unit volume of the flame **("Notation": Σ; section 3.3)**

b. expressing flame progress as generation of the flame surface area density in terms of at least one of a turbulent combustion and a laminar combustion **(section 2.2.1 "turbulent flow")**

c. determining flame growth resulting from turbulent combustion as a function of a turbulent Reynolds number **(section 2.2.1)**

d. modeling the flame propagation based on the flame growth **(abstract; equation 14)**.

e. optimizing combustion within a combustion chamber using the flame propagation **(section 1.2 3rd paragraph)**

Regarding claim 2:

Poinsot discloses determining the flame growth resulting from laminar combustion as being proportional to both a laminar flame speed and to a ratio of temperature of a burned portion to a temperature of a burned portion to a temperature of an unburned portion **(section 7.1)** and as a function of the Karlowitz number **(section 3.3).**

Regarding claim 3:

Poinsot discloses the as recited in claim 1, wherein the generation of the flame surface area density is expressed as a combination of the turbulent combustion and the laminar combustion **(section 7.1)**.

Regarding claim 4:

Poinsot discloses the flame propagation modeling method as recited in claim 1, wherein the flame growth resulting from the turbulent combustion is calculated based on the flame growth being proportional to both the turbulent Reynolds number raised to an exponential power and a stretch rate of the flame **(equations 4 and 8: growth depends on the flame stretch, which also controls the rate of chemical reaction)**.

Regarding claim 5:

Poinsot discloses expressing flame generation as transport of the flame surface area density, which is expressed in terms of flame growth resulting from turbulent combustion and flame growth resulting from laminar combustion; and the flame growth resulting from laminar combustion being expressed as proportional to the laminar flame speed, to the ratio of the temperature of a burned portion to the temperature of an unburned portion, and to an exponential function of the Karlowitz number **(sections 2.2.1, 3.3, 7.1; equations 4 and 8).**

Regarding claim 6:

Poinsot discloses the flame propagation modeling method as recited in claim 5, wherein the exponential function of the Karlowitz number is the base of the natural logarithm raised to the power of the Karlowitz number **("Notation" Karlovitz Number)**.

Regarding claim 9:

Poinsot discloses the flame propagation modeling method as recited in claim 1, wherein the flame generation is further expressed as transport of the flame surface area density **(section 2.1)**, which is expressed in terms of flame growth resulting from turbulent combustion and flame growth resulting from laminar combustion **(equations 4 and 8; section 7.1)**; and the flame generation is suppressed by a resistance force imposed by air **(section 3.2).**

Regarding claim 11:

Ponsoit discloses a method of modeling flame propagation comprising:

a. defining a flame surface area density of a flame as a flame surface area per unit volume of the flame **("Notation": Σ; section 3.3)**
b. expressing flame progress as generation of the flame surface area density in terms of at least one of a turbulent combustion and a laminar combustion **(section 2.2.1 "turbulent flow")**
c. determining flame growth resulting from laminar combustion **(section 7.1)** as being proportional to both a laminar flame speed and to a ratio of a temperature of a burned portion to a temperature of an unburned portion **(equations 1 and 2)** and as a function of the Karlowitz number **("notation")**
d. modeling the flame propagation based on the flame growth **(abstract; equation 14)**.
e. optimizing combustion within a combustion chamber using the flame propagation **(section 1.2 3rd paragraph)**

Regarding claim 12:

Poinsot discloses the as recited in claim 1, wherein the generation of the flame surface area density is expressed as a combination of the turbulent combustion and the laminar combustion **(section 7.1)**.

Regarding claim 13:

Poinsot discloses the flame propagation modeling method as recited in claim 1, wherein the flame growth resulting from the turbulent combustion is calculated based on the flame growth being proportional to both the turbulent Reynolds number raised to an exponential power and a stretch rate of the flame **(equations 4 and 8: growth depends on the flame stretch, which also controls the rate of chemical reaction)**.

Regarding claim 14:

Poinsot discloses expressing flame generation as transport of the flame surface area density, which is expressed in terms of flame growth resulting from turbulent combustion and flame growth resulting from laminar combustion; and the flame growth resulting from laminar combustion being expressed as proportional to the laminar flame speed, to the ratio of the temperature of a burned portion to the temperature of an unburned portion, and to an exponential function of the Karlowitz number **(sections 2.2.1, 3.3, 7.1; equations 4 and 8).**

Regarding claim 15:

Poinsot discloses the flame propagation modeling method as recited in claim 5, wherein the exponential function of the Karlowitz number is the base of the natural logarithm raised to the power of the Karlowitz number **("Notation" Karlovitz Number)**.

Regarding claim 19:

Poinsot discloses the flame propagation modeling method as recited in claim 1, wherein the flame generation is further expressed as transport of the flame surface area density **(section 2.1)**, which is expressed in terms of flame growth resulting from turbulent combustion and flame growth resulting from laminar combustion

(equations 4 and 8; section 7.1); and the flame generation is suppressed by a resistance force imposed by air **(section 3.2).**

Allowable Subject Matter

7. Claims 7, 8, 10, 16-18 and 20 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph and 35 U.S.C. 101 set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter:

Regarding claims 7 and 16:

The prior art of record does not disclose:

$$S_T = \alpha_1 (Re_t)^{\alpha_2} \Gamma \frac{\varepsilon}{\kappa} \Sigma$$

Regarding claims 8 and 17:

The prior art of record does not disclose

$$S_L = \beta_1 \exp(-\beta_2 Ka) \frac{T_b}{T_u} U_L \Sigma^2,$$

Regarding claims 10, 18 and 20:

The prior art of record does not disclose:

$$\frac{\partial \Sigma}{\partial t} + \frac{\partial u_i \Sigma}{\partial x_i} = \frac{\partial}{\partial x_i}\left(\frac{\nu_t}{\sigma_\varepsilon}\frac{\partial \Sigma}{\partial x_i}\right) + \alpha_1 (Re_t)^{\alpha_2} \Gamma \frac{\varepsilon}{\kappa}\Sigma + \beta_1 \exp(-\beta_2 Ka) \frac{T_b}{T_u} U_L \Sigma^2 - D$$

Conclusion

8. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee

pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Examiner's Remarks: Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner. In the case of amending the claimed invention, Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shambhavi Patel whose telephone number is (571) 272-5877. The examiner can normally be reached on Monday-Friday, 8:00 am – 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571) 272-22792279. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SKP

/Kamini S Shah/
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